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Wounds of the pregnant uterus.

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In continuation of former experiments to determine the influence of functional conditions upon processes of cell growth and cell necrosis in the ovaries, investigations of a similar character were undertaken on the pregnant uterus of the guinea pig. As is well known, the pregnant uterus responds to the stimulation of the fertilized ovum by the production of decidual tissue. It was thought possible that in the beginning of pregnancy the uterus might respond also to other stimuli such as wounds, in a way different from the ordinary uterus. Experiments were carried out in twenty six guinea pigs at different stages of pregnancy. Wounds were made in various directions in the uterus, or part of the wall of the uterus was inverted so that the mucous membrane was turned outside. It was found that at a certain stage of pregnancy, namely from the fourth to the sixth day, nodules of decidual tissue were formed at places where the continuity of the uterus had been interrupted or where the mucous membrane had been inverted. Serial sections of these nodules show that they consist of typical decidual tissue which does not include a developing ovum. The number of these nodules was either larger than the number of corpora lutea present in the ovaries which had been cut into serial sections or in other cases corpora lutea were present on only one side of the animal while the decidual nodules were present in both horns of the uterus. Under those conditions it is not likely that the formation of the decidual nodules was caused by the direct stimulation of an ovum, but it is more likely that, at the period of pregnancy, when the development of

decidual tissue begins to take place normally, other stimuli are also able to call forth the production of decidual nodules. At the present stage of the investigation I do not, however, wish to deny positively that a brief contact of the ovum with a wound of the uterus or with the inverted mucous membrane of the uterus is necessary for the production of decidual nodules. Between the third and fourth week after impregnation such nodules become necrotic. They resemble small tumors which originate under chemical stimulation, and are of a transitory character because the stimulus is transitory. They might be called benign deciduomata and be classed among that variety of new growths which I designated as transitory tumors and of which the corpus luteum might serve as a prototype. Among the animals experimented upon in the first three days of pregnancy, only once a deciduoma was found.

These experiments may also be of interest in so far as they seem to show that under ordinary conditions it is not possible to produce an abdominal pregnancy in the guinea pig by various injuries of the uterus; although it may be assumed that under the conditions of the methods of experimentation adopted by me, the ovum had, in many cases, easy access to the abdominal cavity. In no instance did the peritoneal cavity show any change in the course of these experiments. We may, therefore, assume that the entrance of the ovum into the abdominal cavity is usually not sufficient to produce an abdominal pregnancy.

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The effect of light on the staining of cells.

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Former studies of the structural changes in blood cells, especially of the behavior of cell granules under the influence of different external conditions, made it desirable to investigate the behavior of cells in different staining solutions, especially in solutions of vital stains. In the course of various investigations, it was found that solutions not only of eosin but also of other stains, as neutral red, affect the cells very differently in light and in dark. That eosin and other fluorescent substances are much more poison-

ous for cells and for ferments in light than in dark has been previously shown by von Tappeiner, Raab and a number of others. The results of my investigations which were carried out (partly with the coöperation of Mr. L. P. Shippen) in the summers of 1905 and 1906, the last experiment having been done at the end of August, 1906, may be summarized in the following way :

1. In solutions of dyes (neutral red, eosin, methylene blue, methyl violet and others), cells (eggs of *Asterias*) are stained differently according to whether the cells and solutions are exposed to the light or kept in the dark.

2. Combination of an acid and a basic dye (eosin and methylene blue) increased markedly the differences in the staining of the cells in the light and in the dark, in so far, as a small addition of methylene blue to eosin suffices to increase very much the staining reaction which is characteristic for light. The same holds good, probably, for other combinations, as neutral red and eosin. A mutually neutralizing or antitoxic effect of basic and acid dyes does, therefore, not exist. This increase in the effect of a combination of methylene blue and eosin is not caused by a primary change which the light produces in the solutions. Solutions of dyes which have been previously exposed to light do not stain the cells in the dark differently from solutions which had not been exposed to the light. In a combination of two basic dyes (methylene blue and neutral red) methylene blue and neutral red substitute each other in the dark according to the proportions in which they are mixed. In the light the cells assume a tone intermediate between neutral red and methylene blue.

3. The difference in the staining of cells in the light and dark is caused by at least two different effects of the light. (*a*) The light causes primary changes in the cells, and the difference in the staining of cells in the light and in the dark is caused by those primary changes which the light produces in the cells. This applies to staining with eosin, neutral red and with certain mixtures of eosin and methylene blue and eosin and neutral red. (*b*) The light changes primarily the staining solutions and the staining of the cells corresponds to the primary changes in the staining solutions. This applies to staining with pure methylene blue and to such mixtures of methylene blue and eosin in which much methy-

lene blue is present. It also applies, perhaps, to solutions of hematoxylin. The staining of the cells in the light as well as in the dark depends also upon the proportions in which both dyes are present in the mixture.

4. It is possible to distinguish the two factors stated under *a* and *b* by killing the cells with heat. The effect of light upon the cells which is caused by its direct action upon the cells, disappears if the cells have been previously killed. The changes, on the contrary, which are secondary to the primary changes in the staining solutions are still present.

5. Means which diminish the oxidative processes in the cells (*e. g.*, addition of KCN, carrying through of hydrogen through the solution) and saturation of the solution with oxygen, do not modify markedly the differences in the staining of the cells in the light and in the dark. It is, therefore, not probable that the light influences the staining of the cells by causing an increase in the oxidative processes. The addition of alkali to the staining solution is likewise without influence upon the staining of the cells in the dark and in the light.

6. A series of observations on the behavior of different ova and larvæ in the different staining solutions render it probable that the influence of the light depends partly at least upon the injury or death of cells which is caused by light, if the cells are in staining solutions, and that the differences in the action of the stains are therefore secondary. Actively swimming blastulæ and gastrulæ stain differently with eosin on the one hand, and with neutral red and methylene blue on the other hand. With the two latter dyes, especially with neutral red, the external layers of healthy cells are stained. With eosin, on the other hand, those cells of blastulæ and gastrulæ are stained which were cast off either into the inner cavity or to the outside of the organisms.